

SUMMARY OF RESEARCH - FY85

RESEARCH PROGRAM
DIVISION OF PLANNING
NORTHERN REGION

ALASKA DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

2301 Peger Road
Fairbanks, Alaska 99701-6394

June 1985

Richard Knapp	Commissioner
Warren Sparks	Deputy Commissioner Headquarters
H. Glenzer, Jr.	Deputy Commissioner Northern Region
Mim Dixon	Director, Division of Planning Northern Region
Larry R. Sweet	Research Manager, Division of Planning Northern Region

FOREWORD

There have been several organizational changes affecting the Statewide Research Program during the past year and we might expect more changes in the future. We make these changes with an eye to efficiency and effectiveness, getting more for our research dollars.

As we consider various organizational alternatives, we are continually seeking better ways to integrate research into the Department. But integration is more than a matter of organization - it is a way of thinking. The responsibility for integrating research rests with everyone in DOT&PF. Each engineer, each operator, each mechanic, each individual so vital to our team must incorporate innovation into their way of thinking about their jobs.

Innovation. It means taking research findings and implementing them into practice. And more. It means brainstorming, thinking of new ideas and new ways to solve problems. We count on people in the field to help guide the research effort through their innovative ideas.

We must be wary of tunnel vision that comes from doing things the way they always have been done. Research is the key to strategic planning. It enables us to look to the future with an open mind and a vision of a transportation system and public facilities which are better than those we have today.

H. Glenzer, Jr.
Deputy Commissioner

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SECTION 1

STATEMENT OF PURPOSE

Goals of the Research Programs of the Department of Transportation and Public Facilities are to reduce costs, improve efficiency and increase the serviceability of state facilities and transportation systems by better understanding materials, methods, and the environments in which they are used.

The objectives of research are to develop new technical knowledge and implement that knowledge into common use within the Department.

The Research Program is engaged in a broad spectrum of investigations that include highways, buildings and energy related problems, transportation systems research, airport and aviation investigations, ports and harbors.

The Research Section only investigates applied research ideas which can show a potential of being useful within the Department and can show a payback in a relatively short period of time.

Research is performed by staff engineers, consultants in the private sector, University faculty, and other government agencies.

Funding for research comes mainly from the State of Alaska General Fund and the Federal Highway Administration Highway Planning and Research (HPR) program. Additional funding comes from other federal agencies, such as the Department of Energy and the Federal Aviation Administration.

Priorities for research projects in two general areas -- highways and facilities -- are established by two research Advisory Boards whose members are selected from the Divisions of Design and Construction, Maintenance and Operations, and Planning in each Region of the Department. The Marine Highway System is represented on the Facilities Research Board.

SECTION 2 FACILITIES AND EQUIPMENT

Facilities

The Research Program is housed in the Duckering Engineering Building on the University of Alaska campus in Fairbanks. Research occupies approximately 2500 square feet of office space and shares approximately 4000 square feet of laboratory, shop, and storage space under a joint use agreement with the School of Engineering. Shops include carpentry, machine, welding, and staging areas for construction and testing of equipment.

Laboratory and Test Equipment

Research Program's laboratory and testing equipment include high temperature ovens and low temperature chambers for testing materials under broad temperature extremes, and hydraulic testing machines for tension and compression loading of up to 250,000 pounds. One hydraulic test unit is equipped with an environmental chamber capable of testing samples from -40 degrees Fahrenheit to +400 degrees Fahrenheit.

Facilities permit a variety of soil testing. Common tests include consolidation testing, triaxial strength testing, frost heave testing, and gradation and aggregate soundness tests. A jaw crusher is available for preparation of samples.

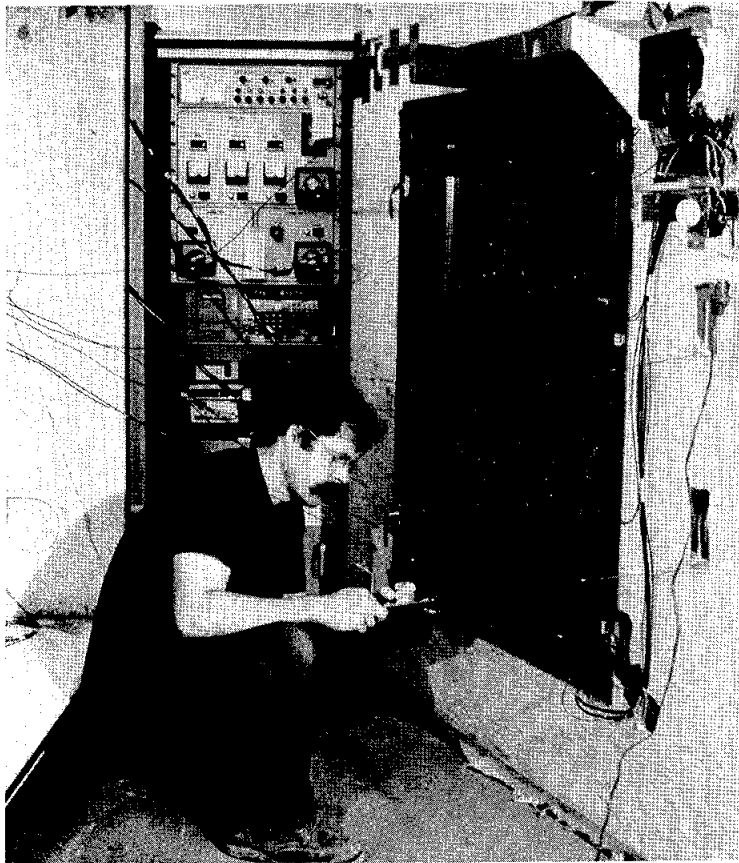
The laboratory is equipped for a full range of standard tests for asphalts, including ductility, penetration, viscosity, abson recovery, and mix designs. In addition, the Research Unit has special equipment for indirect tensile testing and for determining resilient modulus of asphalt concrete.

Limited metalurgical testing can be done, including Rockwell Hardness classification, tensile strength determination, and Charpy impact testing. A muffle furnace is available.

Environmental chambers include two walk-in cold rooms for testing products under controlled conditions. An American Society for Testing Materials (ASTM) guarded "hot box" thermal testing apparatus is used for testing window, door, and wall systems under controlled conditions.

Air infiltration and air quality equipment have the capability of measuring impurities down to 50 parts per trillion.

A Falling Weight Deflectometer (FWD) is available for pavement condition analysis. Also available are rut measuring equipment and a Mays Ride Meter to determine roadway roughness.



Building Materials Testing: University of Alaska student Ralph Stevenson tests a window system in the Guarded Hot Box. This facility is used to measure the thermal conductivity of building materials.

SECTION 3

STAFF

Dean J. Baldassari	Engineering Aide
Dianna Blair	Accounting Technician
Al B. Brawner	Research Engineer
Richard W. Briggs	Electronics Technician
Ethel M. Chandler	Clerk Typist
Billy G. Connor, P.E.	Senior Research Engineer
David C. Esch, P.E.	Highway Research Manager
Nikki D. Harlan	Clerk Typist
Lorena A. Hegdal	Research Engineer
Stephen A. Kailing, P.E.	Senior Research Engineer
Leroy E. Leonard	Facilities Research Manager
Robert L. McHattie, P.E.	Senior Research Engineer
Firmin S. Murakami	Drafter
Carol L. Pederson	Materials Lab Technician
Matthew K. Reckard	Research Engineer
John F. Rezek, P.E.	Senior Research Engineer
Larry R. Sweet	Research Manager
Catherine A. Voigt	Clerk Typist

The staff listing above reflects those persons who worked in the Section for part or all of fiscal year 1985.

The Research Program borrows engineering staff from other Divisions of the Department during part of the year. These engineers bring to the Research Program knowledge of practical problems they face in the field in the accomplishment of their everyday tasks. These exchanges of personnel promote communication and help in the implementation of new technology within the Department.

SECTION 4
RESEARCH PROGRAMS

Highway Research Program

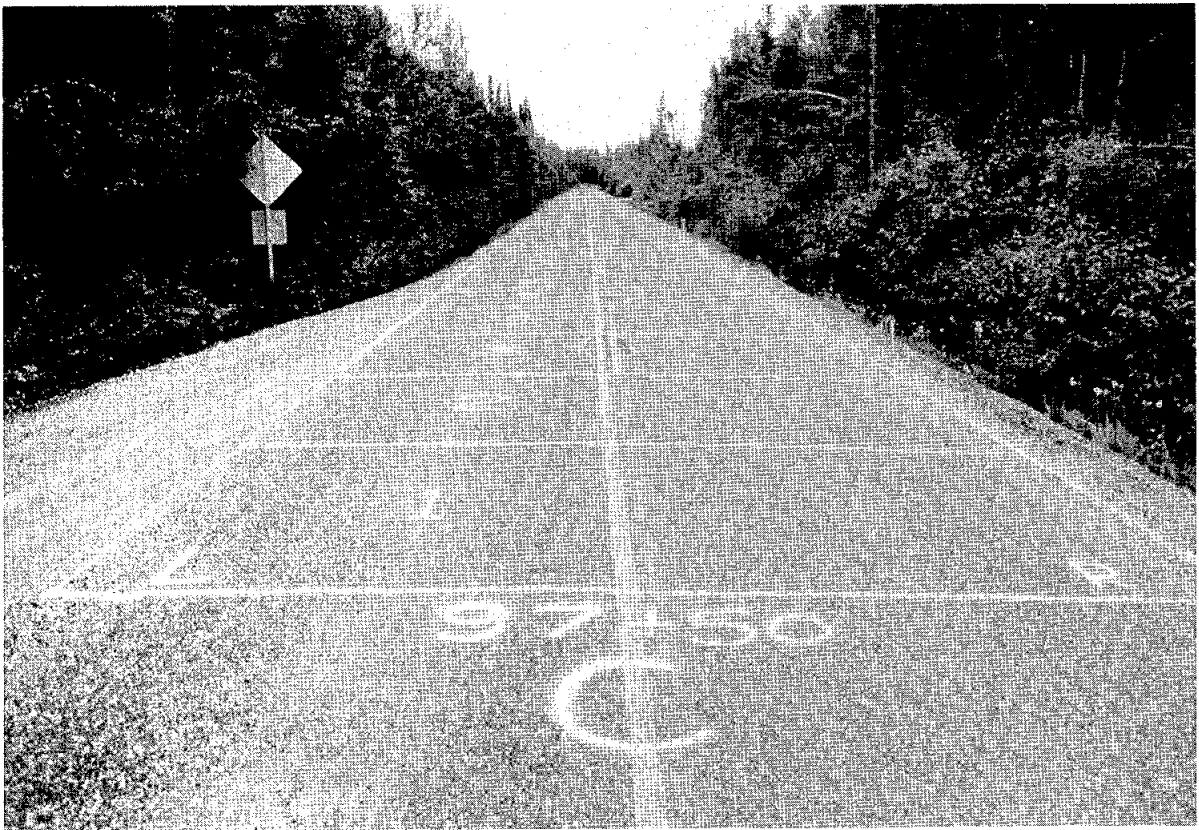
The FY85 Highway Research Program consisted of 27 active projects funded by Federal Highway Planning and Research (HPR) funds, and 26 projects funded by State appropriations. Of these, 17 were studies commencing in FY85 while the remainder involved continuation of prior year work items. These projects are grouped into program areas and summarized in order of emphasis and expenditures. Based on FY85 expenditures which totalled \$995,000, these program areas and their percentages of total highway research funds expended were:

<u>Subject Area</u>	<u>% of Total Funds</u>
1. Pavement Management	24%
2. Pavement Structures	17%
3. Bridges and Culverts	13%
4. Permafrost Studies	12%
5. Safety Research	11%
6. Frost Action and Heave	9%
7. Thermal Model Studies	6%
8. All Other Studies	<u>8%</u>
	100%

Pavement Management Studies. In 1985 a contract was awarded for development of a Pavement Management System for Alaskan highways. This project, funded by Federal Highway Planning and Research (HPR) dollars, is being coordinated with past and current research studies which presently comprise about 24% of highway research expenditures. Pavement overlay life studies, weigh-in-motion equipment evaluation and implementation, and

measurements of spring and summer strength levels on selected routes using the FWD dynamic testing trailer are current pavement management related activities. Annual and biennial pavement condition surveys are made by research personnel to provide the critical input for management pavement repairs and reconstruction activities.

Considerable analysis has been made on the consequences of continuing to allow, versus banning the use of, liftable third axles on large trucks. Data has shown that such axles cannot carry their full share of the gross load under the best of conditions and that they frequently are lifted to carry no load. As a result, plans have been made to phase out such lift axles over a two year period in Anchorage for a slight increase in allowable axle loads.



Surface Condition Observations to Measure Performance of Hi-Float Emulsion Surface Treatments.

Research has shown that prior truck weight information has been inadequate. With the new equipment for evaluating actual truck loadings and for measuring the actual pavement strength and response under loadings, the performance life, and most economical design alternatives can now be predicted for new and reconstructed roadway structures.

With the new pavement management system in place in 1986, it will be possible to determine effects of different funding strategies on the future condition of Alaska's roadway pavements based on historical records, actual roadway strength data and accurate traffic loading data.

Pavement Structure Research. A total of 11 studies are currently active in the areas of pavement design, response to loadings, thermal cracking, and material properties. Studies of the effects of salts on the freeze-thaw response of granular layers are underway. The benefits of using 3% of



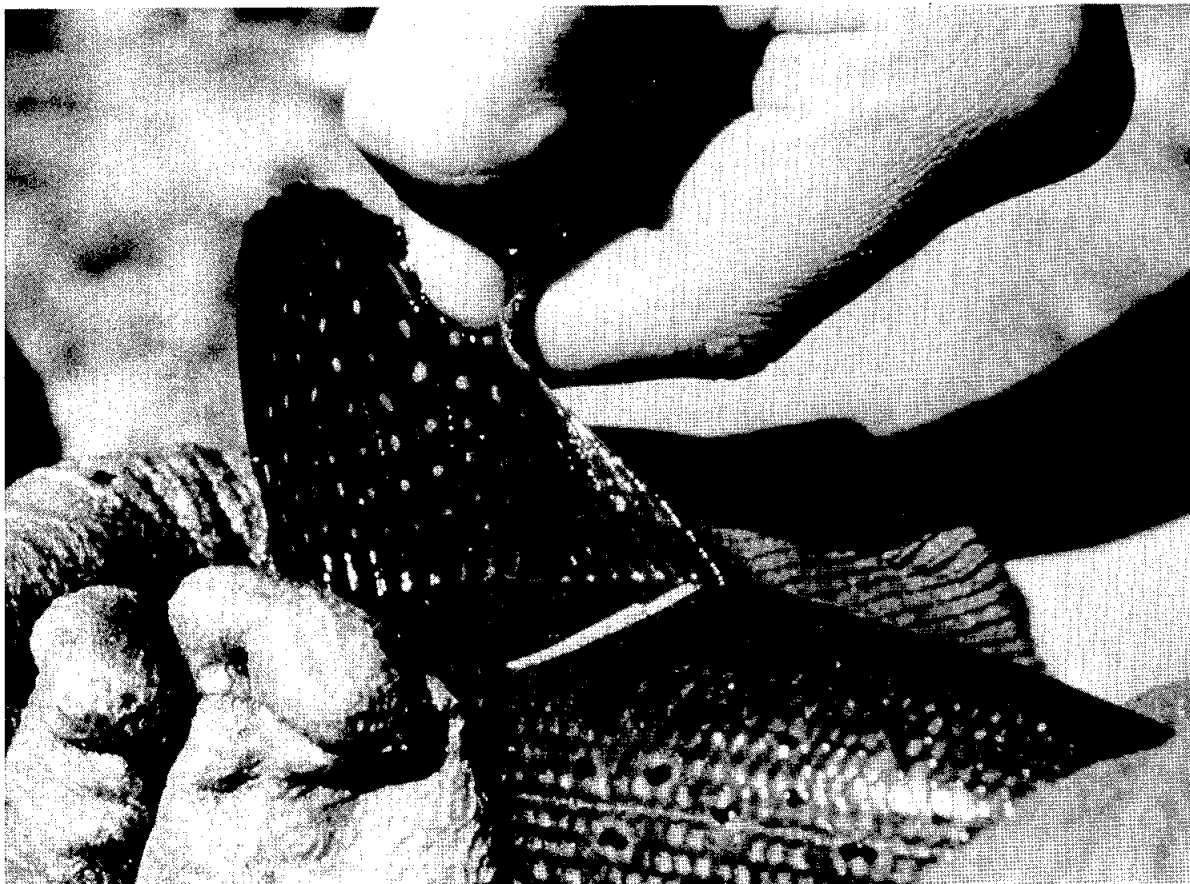
Installation of Experimental Sand Confinement Grids Beneath Shishmaref Airfield Runway.

coarse rubber granules in an asphalt paving mix have been investigated and the final report completed. This project has resulted in the specification of rubber-modified asphalt pavements for several miles of new highway in the Fairbanks and Anchorage areas. The addition of rubber to pavements has been found to reduce icy-road stopping distances by 25%. These benefits have persisted for several winters and appear likely to continue over the life of such pavements.

An interesting new approach to the construction of the stable paved surfaces over fine sands is the use of a cellular honeycomb-like structure referred to as "sand grid" under the trademark "Geoweb." This easily expandable 8" high polyethylene based produce is shipped flat to minimize the volume. Each section is then stretched manually to cover a 20' X 8' area, filled with sand by an end-loader, and then topped with a conventional pavement. This approach greatly reduces the requirement for gravels and has obvious economic advantages in remote, gravel-poor regions.

Bridge and Culvert Research: Studies in this area include river and stream hydrology investigations to develop new design methods and standards for Alaskan conditions, and culvert studies aimed at the problems and solutions for assuring fish passage through roadway culverts. The high value placed on Alaska's fishery resources makes work in this area of critical importance. The protection of fisheries at the lowest cost to the State is of major concern. The State has in the past spent large sums for construction of bridges dictated solely by hydrologic and biological assumptions regarding the abilities of fish to transit upstream during near-peak flood conditions. Research work is directed at reducing the unknowns in these equations. The goal is to prevent construction of unnecessary bridges when less expensive culvert structures can be used.

An investigation just completed involved the reinforcement stress monitoring on a major bridge recently constructed between Juneau and Douglas, Alaska. In this study, the load and temperature-induced steel stresses were measured and compared with design assumptions. The structure of concern was an innovative segmentally cast pre-stressed concrete bridge. Information from this type of investigation is very useful for engineers working on the design of similar structures for other areas.



Researchers tag grayling prior to study of fish migration through culverts.

Permafrost Studies: Permafrost Research is probably the oldest type of Highway research performed in Alaska. Field studies commenced in 1953 with the drilling and temperature monitoring of five roadway sites in the Glenallen area. The first plastic foam insulated roadway on permafrost was constructed near Chitina in 1969, and monthly monitoring has continued

uninterrupted at that site for 15 years. Five additional experimental roadway sites have been instrumented and included in a long-term monitoring program. All sites are in "warm" permafrost areas, with ground temperatures above 28° F. Warming effects of the roadway and the side slopes cause the continuous roadway deformations and changes in the permafrost table which are being noted at all sites. This demonstrates the need for a long-term continuing monitoring program to measure the ultimate consequences of any experimental roadway feature.

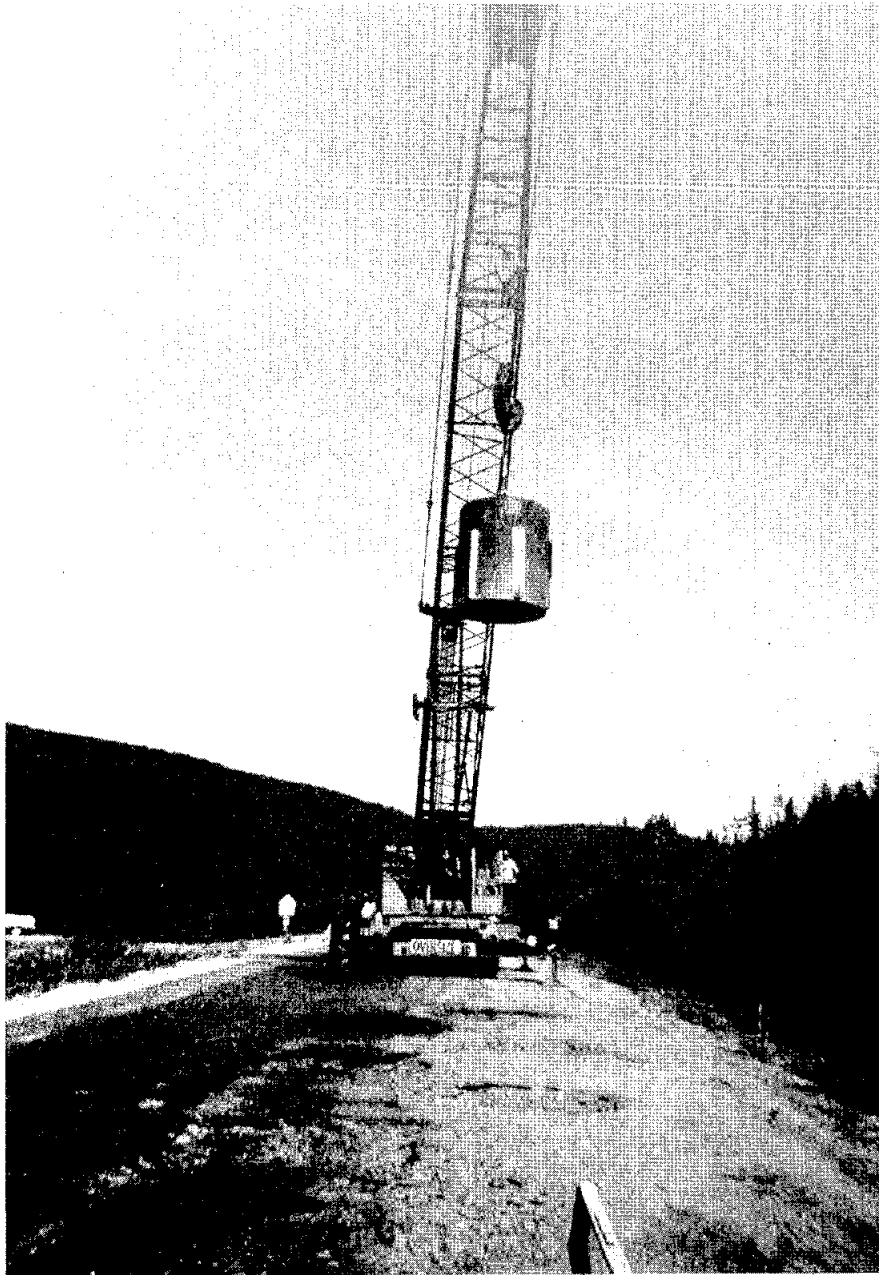
Scientific warnings about global climatic warming through the carbon dioxide related "greenhouse effect" have created particular concerns regarding the long-term stability of all structures founded on warm permafrost. Methods of reducing roadway surface and particularly the slope surface temperatures are being actively investigated. Heat pipes or "thermo-siphons" have been installed at three roadway sites in attempts to increase the wintertime cooling of both the roadway and the adjacent side-slopes. Two installations of wood snow sheds/solar screens are also under field observations.

Five roadway sections have been coated with white paint and temperature observations have documented significant reductions in surface and subsurface temperatures. Unfortunately, this treatment does not persist well under tire wear, and also results in decreased traction and occasional surface ice formation.

The use of engineering fabrics to reinforce road structures over permafrost has expanded greatly in recent years. The abilities of various fabrics to actually support a roadway fill across a subsurface void created by melting ice have been examined in a field test installation. This study has demonstrated that considerable stretch or creep of the fabric occurs. The latest generation of very high strength plastic grids and heavy fabrics may increase our abilities to actually span voids resulting from the thawing of permafrost, but these studies have demonstrated that major settlements and surface distortions must still be anticipated by the highway designer.



Snow Shed/Solar Screen Structures Installed for Control of Permafrost Thawing on Parks Highway.



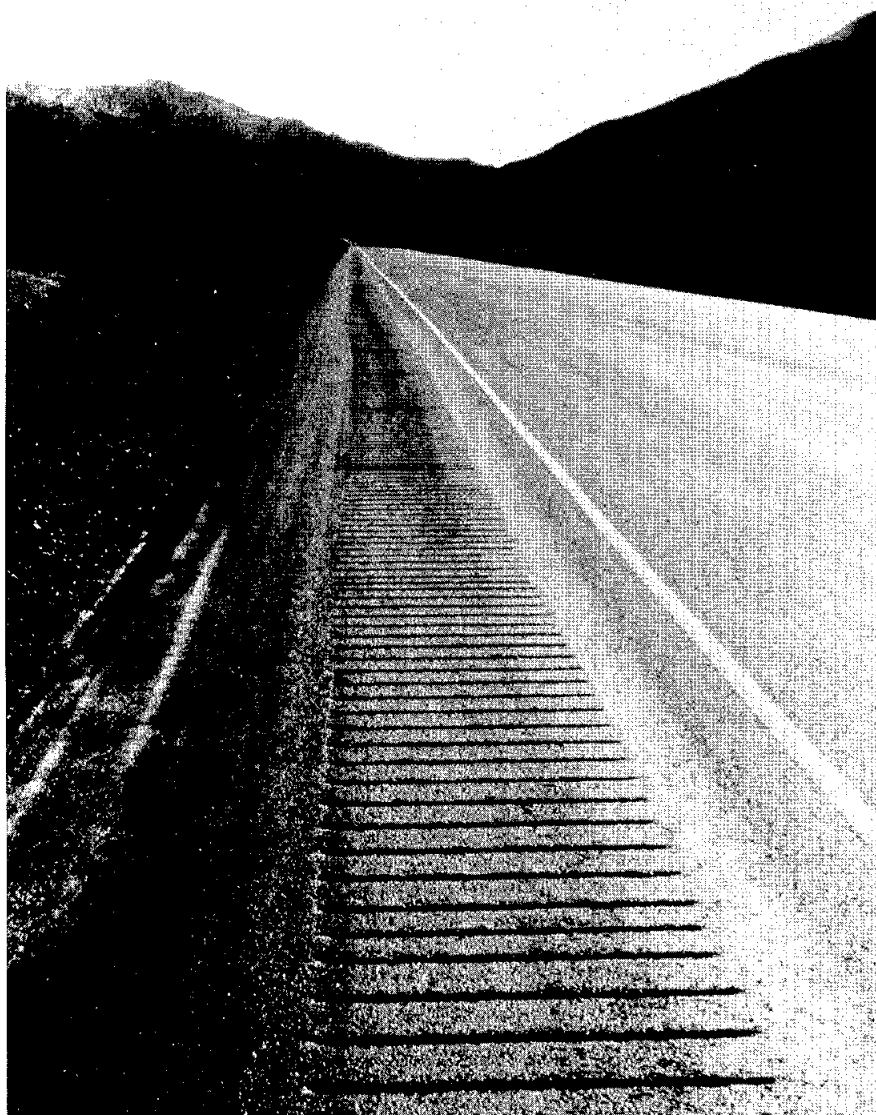
Embankment Recomaction on Elliot Highway for Repair
of Distress from Thawing Permafrost.

Safety Research: Because a major portion of the annual maintenance budget is devoted to snow and ice control work, improved methods for snow and ice control to increase wintertime traction and safety, is the major emphasis of this program area. Heated roadway sands and asphalt pavements with intermixed rubber granules have demonstrated improvements over present technology. Efforts are underway to further develop these areas. Studies of calcium-magnesium acetates (CMA) as deicing agents in lieu of normal calcium and sodium chlorides are also underway. The economic advantages of decreased vehicle and structure corrosion are expected to offset the higher initial costs of acetate salts.

Studies have been completed of the methods and economics of producing CMA in Alaska and on some environmental effects of this material. However, because of significant nationally funded work now underway to investigate further the corrosion potentials of CMA as well as other side-effects, our progress in this area has been placed on hold pending favorable results from that work.

Ice control efforts in the short-term will consist primarily of evaluating the costs and benefits of applying hot sand to treat the problem of road and airfield surface ice deposits. Test track studies completed at Penn State University have demonstrated major benefits from applying heated sand so that melting and freeze-bonding occurs to prevent sand loss under traffic action. If the field studies prove successful, major savings will result from reduced sand quantities and reduced equipment and manpower needs of adequate sand application.

Frost Action Studies: Frost action causes the wintertime distortion of surfaces of roads and airfields and the progressive uplifting or "jacking" of posts and piles. The subsequent thawing and related weakening of frost-susceptible pavement structures results in the need to restrict or eliminate the use of heavy trucks early in the thawing period, with economic consequences for the consumer.



Experimental Installation of Shoulder Area "Rumble Strips" to Alert Sleepy Drivers.

A new test procedure and a computer model for frost heave prediction, developed for the Federal Highway Administration, were evaluated at two Alaskan sites. Revisions in the model have since been made based on this field verification study.

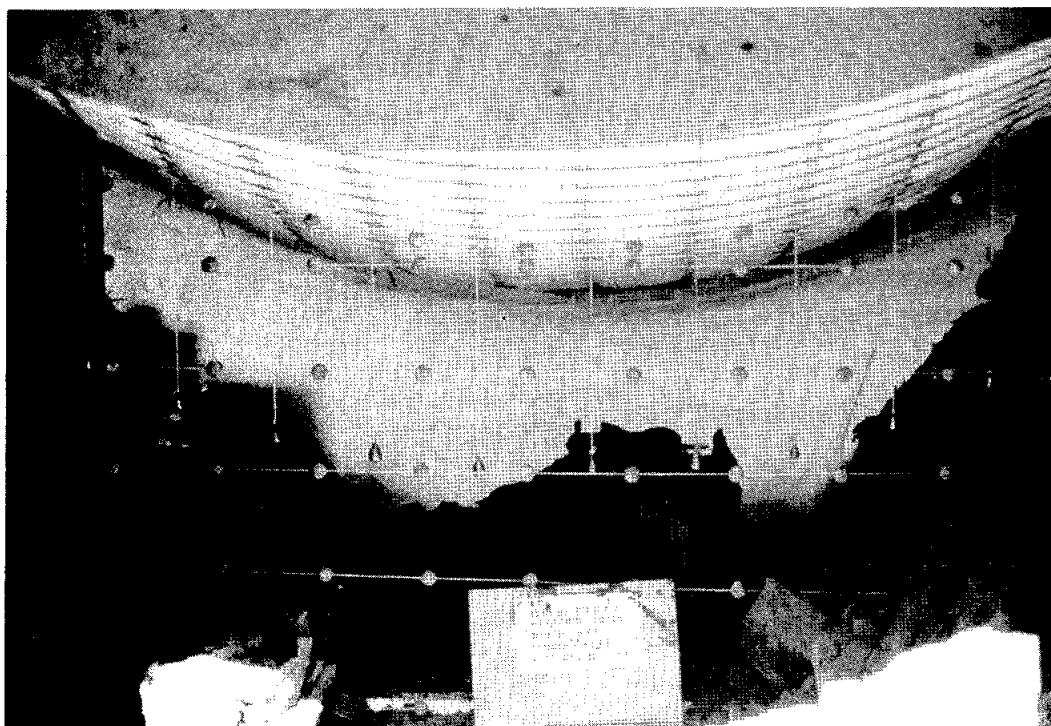
A second area of study under this program is that of frost-jacking of piling. A third winter of computerized observations of two strain-gauge and temperature-instrumented test piles was completed in 1985. After this winter, the soils surrounding these test piles were excavated and the piles were tensioned with a large truck-crane to recalibrate the response of the strain-gauges. A final report and recommendations for computing probable frost-jacking stresses on piling are now being prepared. This research should provide a significant contribution to engineering theory.

Thermal Model Studies: To predict permafrost thawing, frost penetrating and heaving, and the freezing of buried utilities, a useable 2-dimensional thermal model is required. This project is evaluating existing thermal models for their applicability to Alaskan highway design problems. Data on the annual variations in temperature of different surfaces are also being obtained as input for these prediction efforts.

Other Studies: Research efforts grouped under this heading include geophysical detection and remote sensing for permafrost, ground ice, and subsurface rock and gravel deposits. Also included are studies aimed at reducing maintenance costs. Another important research activity is the monitoring and reporting on experimental construction features, such as reinforced earth walls, new types of subdrains, asphalt modifiers, and solar powered railroad crossing signals. The costs of such features are paid from FHWA construction project funds, but long-term monitoring becomes the responsibility of the Research Program. A total of 11 features are currently being evaluated.



Experimental Geofabrics Being Installed Across Trenches
in Studies of Fabric Bridging Over Voids.



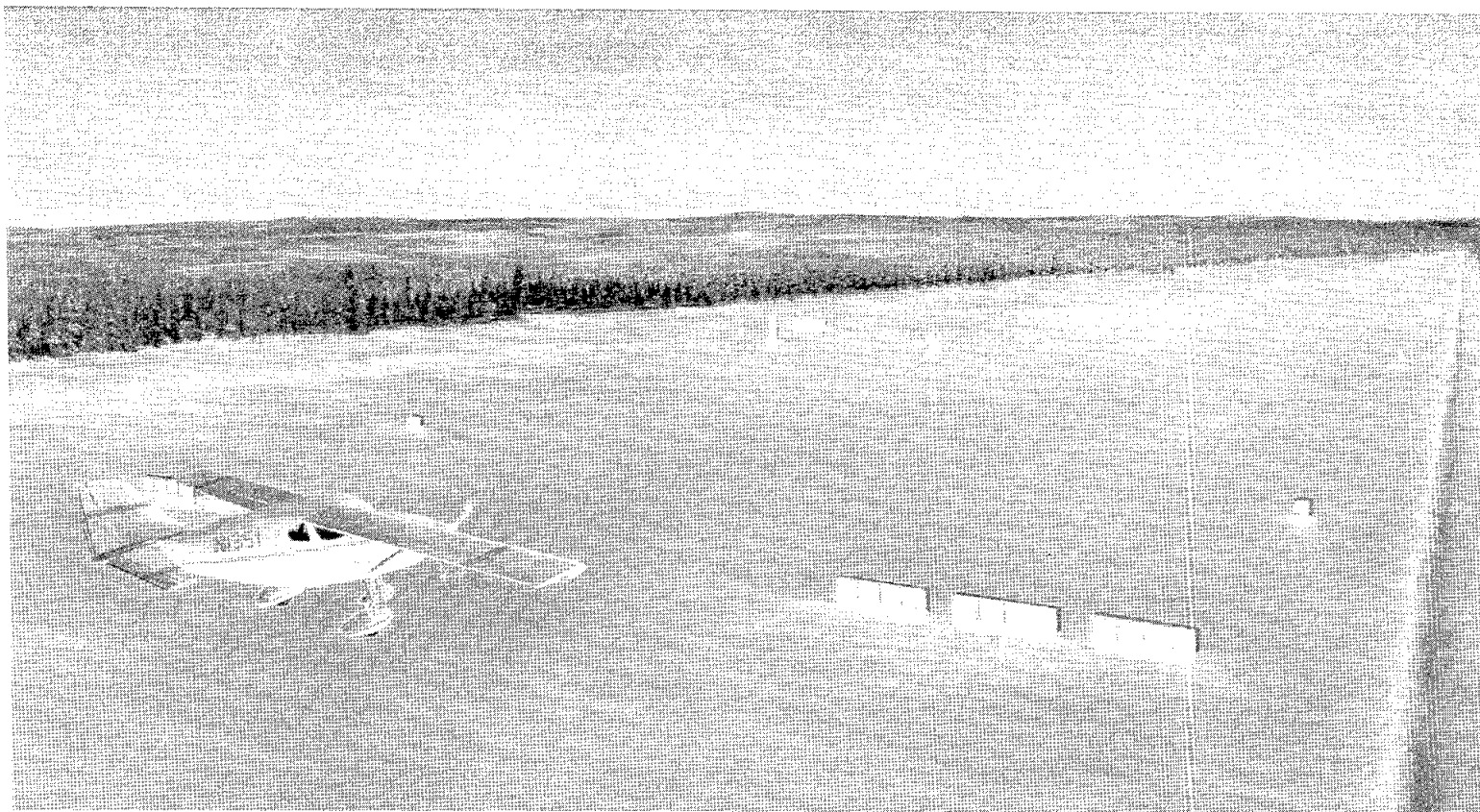
Geofabric Spaning Void as Viewed From Underneath After
Being Loaded.

Facilities Research Program

During FY85 the Facilities Research Program has continued to maintain a broad diversity in the list of projects undertaken. As in FY84, essentially all projects not related to Highways were contained in the Facilities Program. At the beginning of FY85 there were 50 active projects in the program. This number placed an extreme burden on the staff of the Research Section which was undergoing cut-backs due to reductions in the operating budget. Consequently, a major effort was made during the year to close-out projects which did not suggest significant results and projects which had not received the highest of Research Advisory Board priorities. By the end of the fiscal year there were 44 projects within the program of which 26 were active and ongoing and 18 were in the final stages of close-out. To continue to bring the workload into more manageable proportions only two new project starts have been requested for FY86.

<u>Subject Area</u>	<u>% of Total Funds</u>
Aviation Support Systems	36%
Building Science	17%
Environmental Engineering and Pollution Control	12%
Marine Support Systems	5%
Energy Systems	<u>30%</u>
	100%

Aviation Support Systems. The Department owns and operates nearly 200 airports statewide. This is more than any other state. To address the problems of a system so broad requires a special R&D effort. During the past year several projects addressed these problems over a wide range of disciplines. The development of a low cost, reliable edge lighting system for rural runways moved one step closer to implementation with a successful



RADIO LUMINESCENT AIRPORT LIGHTING

A new concept in airporting edge lighting, the Radioluminescent system is currently installed at Central, AK and may soon be implemented into common use at several remote airports across Alaska.

evaluation of the system by the FAA at Richland, Washington in September. It is hoped that this system will be fully approved and operational by the end of FY86. A low-cost landing aid called a BA-VASI is being evaluated for use at small airports as well and work continues on runway embankment stabilization, pavements, and remote weather observing systems.

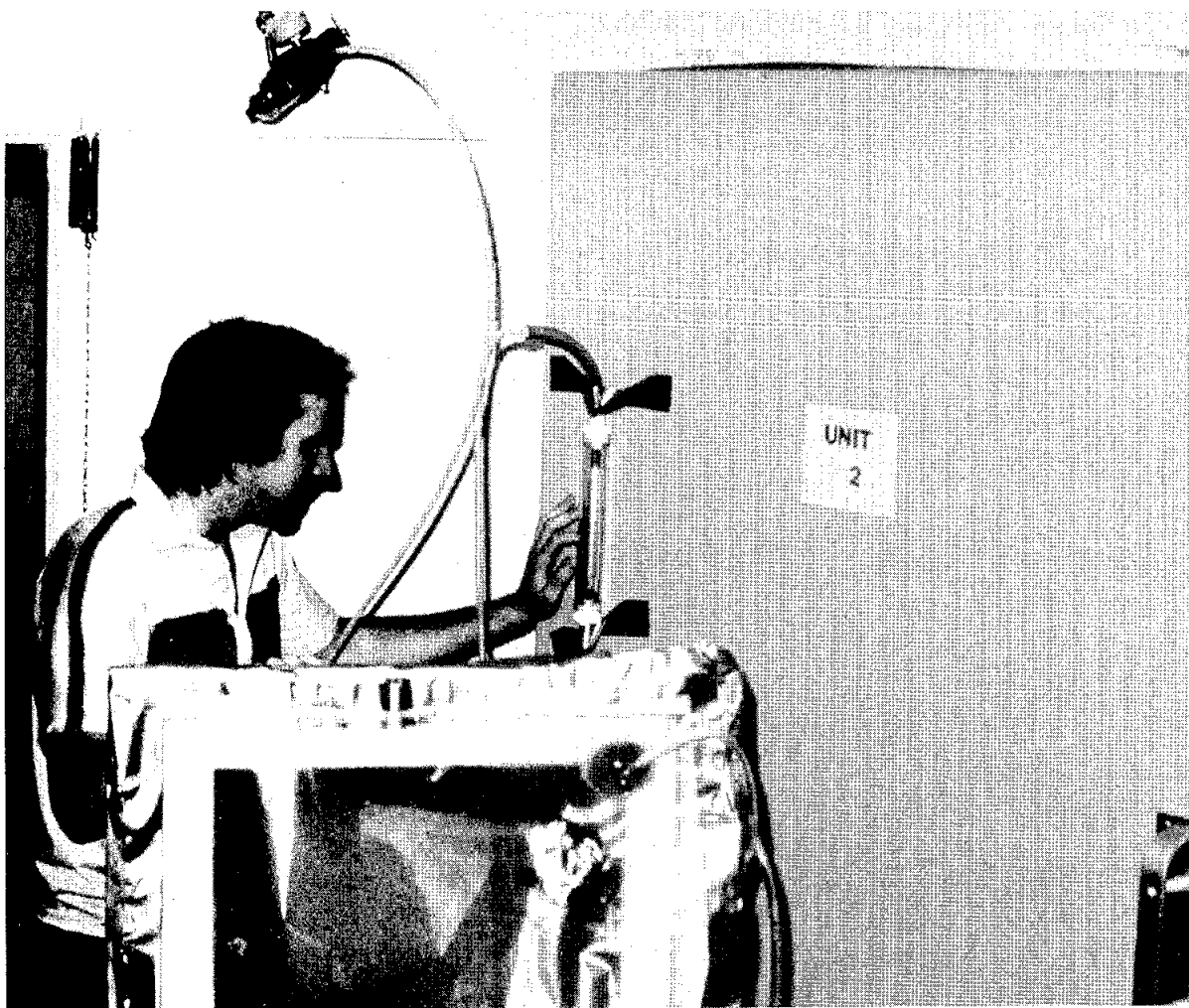
Building Science. The State of Alaska owns more than 17,000,000 square feet of floor space in over 2000 separate building units statewide. Working with the Statewide Standards and Technical Services group of the Department, the Facilities Research program is addressing a variety of problems encountered when constructing and operating this huge inventory of buildings. A project directed toward roof failures deals with one aspect of buildings while a project on the use of heat tubes for soil stabilization of foundations on permafrost treats the other extreme. In between evaluation of window systems, mechanical systems, and the overall energy performance of buildings in the Alaskan environment are subjects of separate projects.

Environmental Engineering. Many aspects of the Department's mission relate to the planning, construction, and/or the operation of systems and facilities which impact the environment. Development of a method to project the automotive emission impact on the urban areas when designing new highway systems has been an ongoing effort of the Facilities Research program. Techniques to monitor air flow in institutional buildings such as jails, hospitals, and schools is another development of the program and during the past year the staff has been called upon several times to utilize the procedure when special problems have been encountered. A demonstration of a waste oil burner at a remote highway maintenance camp combined energy conservation as a potential solution to waste disposal problems which have become a significant problem to the Department. We anticipate that this portion of the work will continue to receive heavy emphasis in the future.

Marine Support Systems. It is an often cited fact that Alaska has more miles of coastline than the rest of the states combined. Historically, marine transportation has been the primary form of travel for goods and passengers to, from, and within the State, and it has only been the past couple of decades that air and highway transportation have eclipsed marine transportation as the dominant passenger mode. But ship remains the primary form of freight transport. In FY85 the Facilities Research program continued its participation in the joint study by the federal governments of both Canada and the United States into the potential for marine transportation in the Arctic. Projects were completed and reports published evaluating two methods of erosion control and a joint project was begun with the University of Washington to investigate improved designs for finger floats used in small boat harbors.

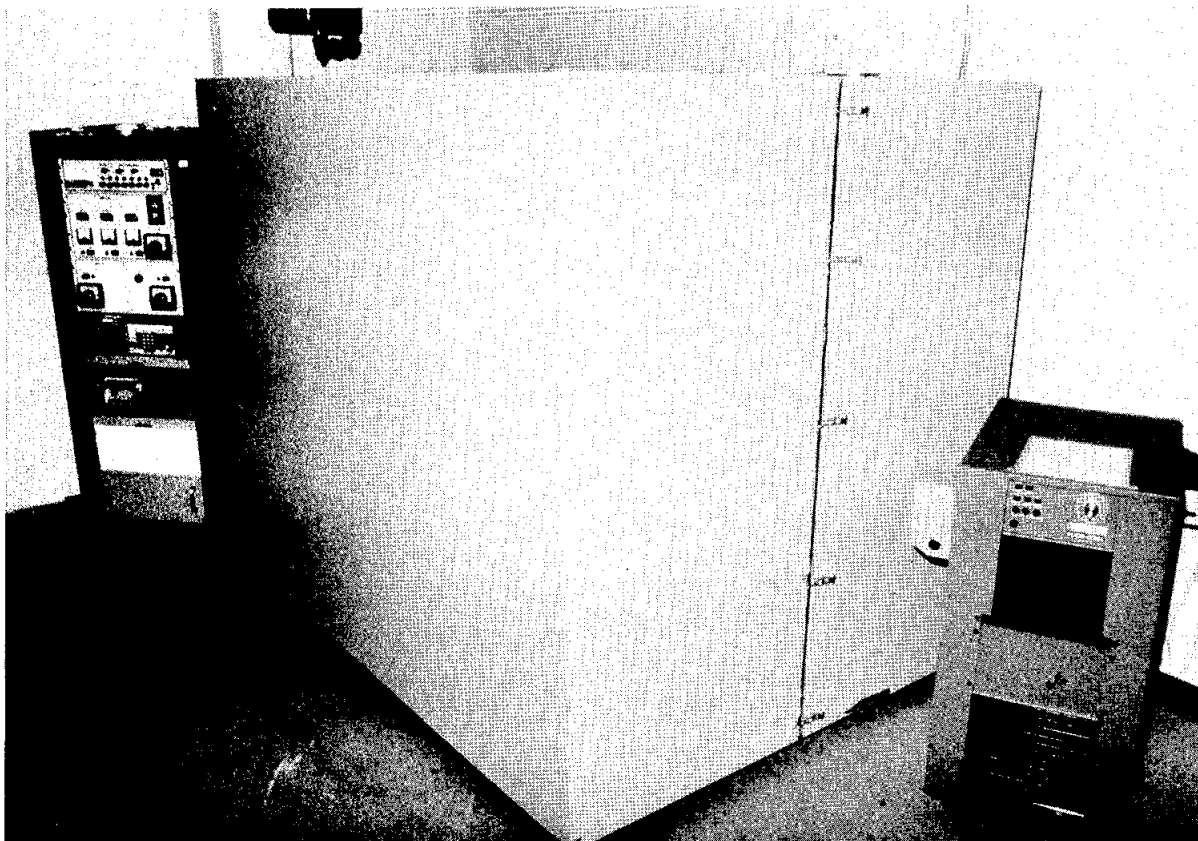
Energy Systems. The task of providing and maintaining reliable electric power to isolated communities and facilities at a reasonable cost continues to be a major problem confronting several State agencies not the least of which is the DOT&PF. A project which documents the problems of poor power quality was completed during FY85 and the report distributed.

This project is expanding with the cooperation of agencies like the Alaska Power Authority and the US Department of Energy to try and assess the cost of this problem to the State and find potential solutions. A companion project examined the diesel electric generator for potential improvements which may in the future help alleviate the power quality problem. It is anticipated that this area of study will continue to receive heavy emphasis as more and more sophisticated electric and electronic equipment becomes common place in State facilities in rural locations. Other projects continue to examine techniques to improve heating and ventilating systems, the problems of buried electric cables in frozen ground, and energy conservation.



Robert Rude Checks Air Leakage Rate

The Facilities Program investigates safety in buildings as well as energy and materials. Egress from living and sleeping room is an item of major concern in northern buildings. Fires spread rapidly due to drafts set up by cold temperatures when building materials are especially dry. In 1985, several window systems were tested. Two were found that are particularly resistant to freezing shut in extreme cold. A report is being published on this work.



Guarded-Hot-Box: This facility is used to measure the thermal conductivity of building materials and components.

SECTION 5 IMPLEMENTATION AND TECHNOLOGY TRANSFER

The end product of research studies is the implementation of the final results into common practice. Implementation and technology transfer are continual processes involving publications, seminars, workshops, papers at technical meetings, work on committees, and public presentations. Listed below are some of those activities in which research personnel participated during the past fiscal year.

Implementation Seminar Series

The Research program sponsored the following seminars during the past year:

"Roadway Research and Design of Pavement Structures in Finland;"
Mr. Martti Eerola, Road and Traffic Laboratory, Technical Research
Center of Finland; Fairbanks, July 12.

"Heat and Mass Transfer at and Near the Ground Surface;" Mr. Barry
Dempsey, University of Illinois; Fairbanks, July 25.

"Use of High Strength Polymer Geogrids for Reinforcing Paved and
Unpaved Roads;" Mr. Ralph Haas, University of Waterloo; Fairbanks,
August 17.

"Low Cost Tunnel Construction Techniques in Norway;" Dr. Nils
Johansen, University of Alaska; Fairbanks, September 17; Juneau,
October 16, Anchorage, November 16.

"Geofabric Reinforced Embankments Over Ice;" Dr. Tom Kinney,
University of Alaska; Fairbanks, September 21.

"Cathodic Protection Systems for Bridge Decks;" Don Jackson,
Federal Highway Administration; Fairbanks, September 26.

"Maintenance Problems in Permafrost Areas;" Dave Esch, DOT&PF, Glennallen, October 8.

"RMA2 and 7 Hydrodynamic Modeling of Open Channel Flow in Two Dimensions;" Eon King and Don Smith, Resource Management Associates; Fairbanks, October 26.

"Geodyn Heat Flow in Earth Masses;" Eon King and Don Smith, Resource Management Associates; Fairbanks, October 27.

"Transportation and Research in China and Permafrost Regions of Inner Mongolia;" Dave Esch, DOT&PF; Juneau, December 5; Anchorage, December 6, Fairbanks, December 20.

"Reevaluation of the 1964 "L" Street Slide;" Dr. Yoshiharu Moriwaki, Woodward-Clyde Engineering Consultants; Anchorage, January 22.

"Prospecting for Gravel in Alaska Using Airborne Electromagnetics;" Mr. F.L. Jagodits, Excalibur International Consultants; Anchorage, February 7-8.

"Interagency Workshop on Fish Passage;" Alaska Department of Transportation and Public Facilities and Alaska Department of Fish and Game; Steve Kailing, DOT&PF; Anchorage, March 1.

"A Personal Computer Solution to the Modified Berggren Equations;" Dr. John Zarling, University of Alaska; Fairbanks, March 8.

"Radioluminescent Airport Lighting," Mim Dixon, Lee Leonard, Lorena Hegdal, DOT&PF; Anchorage, Alaska, March 13.

"Implementation of Radio-Luminescent Airport Lights;" Lee Leonard and Lorena Hegdal, DOT&PF; Central, Alaska, June 18-19.

Other Technology Transfer/Implementation Workshops, Hearings, and Delegations

National Science Foundation: Arctic Civil Engineering Research Priorities--Dave Esch, John Rezek, Larry Sweet, Lee Leonard

Interagency Radio-Luminescent Airport Lighting Workshop, Central, Alaska--Lee Leonard (Chair), Lorena Hegdal

Permafrost Delegation to Northeast China--Dave Esch, Larry Sweet

Research Administrators Delegation to Northern and Eastern Europe--Larry Sweet

Alaska State Legislature House Transportation Committee: Department Research Program--Mim Dixon, Larry Sweet

Facilities Research Implementation Workshop, Fairbanks: Lee Leonard

Carbon Monoxide Pollution Modeling Workshop, Anchorage: Steve Kailing

Facilities Implementation Workshop with Standards & Technical Services, Anchorage -- John Rezek

Facilities Policy Meeting, Anchorage --Lee Leonard

White House Staff Meeting Regarding Radioluminescent Lights, Washington, D.C. -- Mim Dixon, Lee Leonard

Radioluminescent Lighting Implementation Workshop, Oakridge, Tennessee -- Lee Leonard

Facilities Implementation Meetings, Anchorage -- Steve Kailing

Committee Participation

Transportation Research Board:

Pavement Management Systems Committee -- Dave Esch, Billy Connor
Flexible Pavement Design Committee -- Dave Esch
Data Acquisition and Analysis Committee -- Billy Connor
Frost Action Committee -- Dave Esch (Chair)
Strength and Deformation of Highway Materials Committee -- Billy
Connor
Highway Noise Committee -- Dave Esch
Committee on the Conduct of Research -- Larry Sweet

Department of Transportation and Public Facilities Statewide Committees:

Computer Users Group -- Billy Connor
Weight-In-Motion Technical Users Group -- Billy Connor (Chair)
Highway Improvement System Committee -- Billy Connor
Highway Analysis Committee -- Billy Connor
Pavement Management Committee -- Billy Connor (Chair)
Toxic and Hazardous Materials Committee - Steve Kailing
Interagency Task Force on Fish Passage Through Drainage
Structures -- Steve Kailing

American Society of Civil Engineers Highway Division Research Committee --
Larry Sweet

Fairbanks North Star Borough Committees:

Inspection and Maintenance Program Development Committee -- Lee
Leonard

Air Quality Working Group -- Steve Kailing

National Building Thermal Envelope Coordinating Council -- John Rezek

Interagency Carbon Monoxide Modeling Group -- Steve Kailing (Chair)

Interagency Task Force on Fish Migration -- Steve Kailing

Technical Journal Papers

"Description and Evaluation of Alaska's Pavement Rating Procedure" by Billy Connor and Bob McHattie; Transportation Research Record #938, Transportation Research Board, National Research Council

Papers Presented at Conferences

Federal Highway Administration Tri-Regional Pavement Rehabilitation Workshop:

Alaska Methods for Pavement Life Estimation and Rehabilitation
Design Using the Falling Weight Deflectometer -- Bob McHattie

University of Alaska Transportation Forum:

Trends in Highway Pavement Condition in Alaska -- Billy Connor

Survey of Road Construction and Maintenance Problems in
Permafrost Areas -- Dave Esch

Transportation Research Board:

Radio-Luminescent Airport Lights -- Lee Leonard

Sixth Annual Alaska Alternative Energy Conference:

Thermal Performance of Metal Stud Walls -- John Rezek

Insulation Shape Factors -- John Rezek

Illumination Engineering Society Annual Meeting:

Radioluminescent Airport Lighting -- Lee Leonard

Noorvik Airport Lighting Project -- Lee Leonard

American Society of Heating, Refrigeration, and Air Conditioning Engineers
Annual Meeting:

Thermal Performance Standards -- Lee Leonard

American Nuclear Society Annual Meeting:

Radioluminescent Airport Lighting -- Lee Leonard

Other Technical Presentations

American Society of Civil Engineers, Fairbanks Chapter:

Transportation in China -- Dave Esch, Larry Sweet

Highway Load Restrictions -- Billy Connor

Alaska Correctional Industries Annual Meeting:

Calcium Magnesium Acetate Production by Medium Security
Prisoners -- Bob McHattie

North Warning Working Group:

Radioluminescent Airport Lights -- Lee Leonard

Association of Engineering Geologists Annual Meeting:

"L" Street Slide -- Tom Moses, Lorena Hegdal

University of Alaska Engineering Classes

State-of-the-art Pavement Design -- Billy Connor, Bob McHattie

Advisory Board Memberships

Governor's Science and Engineering Advisory Committee -- Larry Sweet

University of Alaska Transportation Center -- Mim Dixon, Larry Sweet

Northwest Technology Transfer Center -- Larry Sweet

Fairbanks North Star Borough Community Research Center -- Larry Sweet

State of Alaska Climate Planning Advisory Group -- Larry Sweet

Public Presentations

Fairbanks Chamber of Commerce Transportation Committee:

Lift Axles on Trucks -- Billy Connor

Administration of Research in Europe -- Larry Sweet

Survey of Research Expenditures in Various Countries -- Larry Sweet

Alaska Truckers Association:

Lift Axles on Trucks -- Billy Connor

College Rotary Club:

Department Research Program -- Billy Connor, Lee Leonard, Larry Sweet

Television Interviews

Radio-Luminescent Airport Lights -- Lee Leonard

Calcium Magnesium Acetate for Road De-Icing -- Bob McHattie

International Research Cooperative Efforts

During the past year we have had exchanges of technical information with the following countries:

Canada: High Float Emulsion Surface Treatment
 Roadway Embankment Salt Content
 Radio-luminescent Lighting Development
 Permafrost Research
 Building Air Quality
 Building Thermal Performance Standards

Finland: Highway Construction Materials and Techniques
 Auto Engine Heating Techniques

Norway: Low Cost Tunnel Techniques
 Use of Insulation Under Roadways

Sweden: Calcium Magnesium Acetate Highway De-Icer
 Egress Window Testing
 Highway Condition Inventory Techniques

China: Building and Embankment Foundation Techniques
in Permafrost Areas

Japan: Soil Stabilization Techniques
Remote and Rural Area Power System Development

England: Sand Confinement Grid Techniques
Frost Action Studies

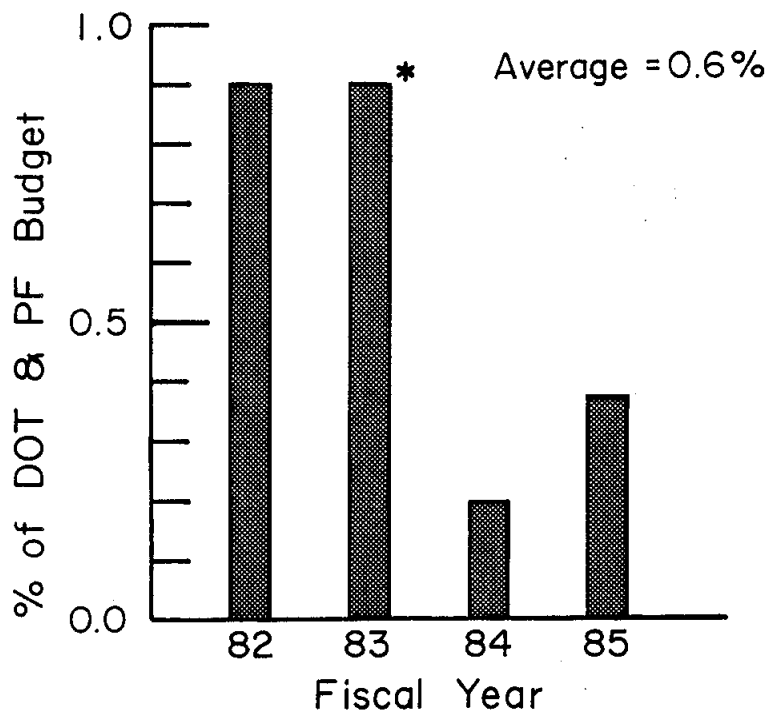
Korea: Rubberized Asphalt

SECTION 6
FUNDING

Funding History

The chart below illustrates the percentage of the total Department budget that has been committed to research for the past four fiscal years. This chart includes funding from all sources--state, federal, and private -- in both the capital and operating budgets. The graph on the following page details the history of the capital budget for research.

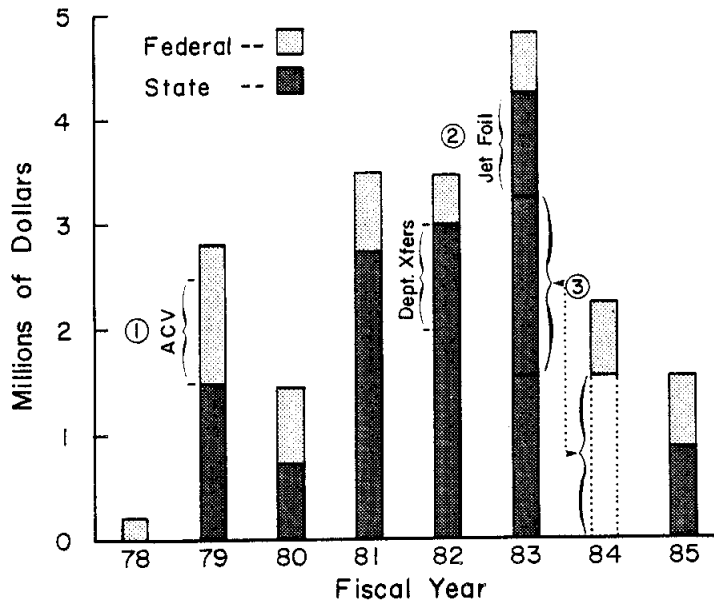
**Research Budget
as a Percentage of Total Department Budget**



*FY 83 includes \$1.2 million
Jet Foil Demonstration

Includes funding from all sources--state,
federal, and private, in both the capital
and operating budgets.

Research Capital Budget

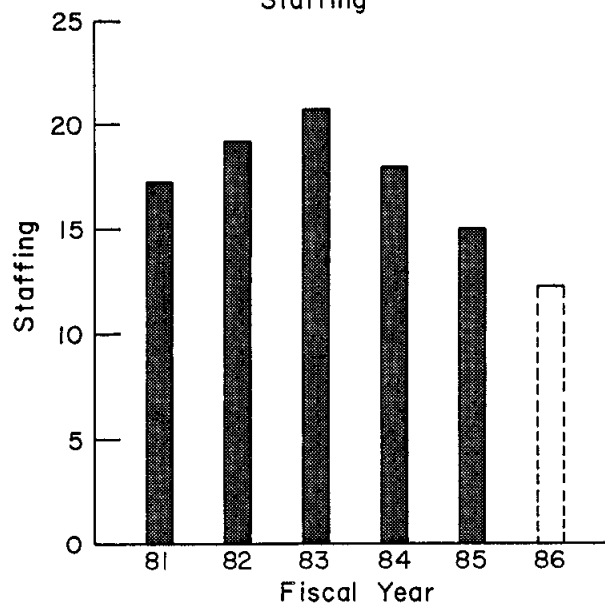


NOTES:

- ① ACV - Federally Funded Air Cushion Vehicle Demonstration
- ② Jet Foil - Demonstration of Boeing Jet Foil in Southeast Alaska
- ③ FY 83-84: No Capital appropriation was made in FY 84;
One-half of FY 83 appropriation was carried forward to FY 84.

The bar chart above summarizes the authorized capital budget funding history for the Research Program since the creation of the Department of Transportation and Public Facilities on July 1, 1977.

Research Section Staffing



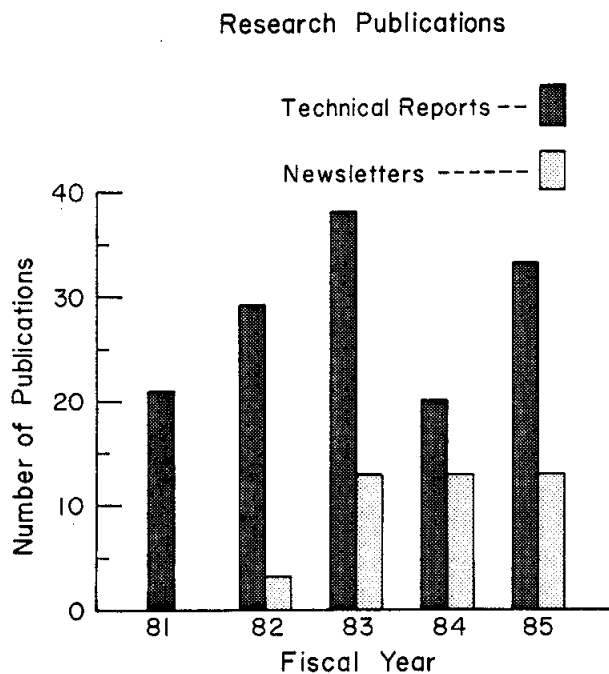
The diagram above depicts the staffing for the Research program since FY81.

SECTION 7 PUBLICATIONS

Listed on the following pages are the technical publications and research newsletters ("Research Notes") produced and distributed by the Research Program during FY 1985.

An asterisk indicates that copies of the reports are no longer available from the Research Program. These reports are in state libraries. Copies may be ordered through the Arctic Environmental Information and Data Center, University of Alaska, 707 A Street, Anchorage, Alaska, 99501, phone number (907) 279-4523.

A complete list of technical publications produced since July 1, 1980, may be obtained by writing to the Research Program, Department of Transportation and Public Facilities, 2301 Peger Road, Fairbanks, Alaska 99701.



The diagram above indicates the numbers of publications each fiscal year since FY81.

ALASKA DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES
RESEARCH SECTION

RESEARCH PUBLICATIONS

FY85

FHWA-

AK-RD-85-01 Hayoe, G.F., Application of Hot Sand for Winter Ice Control, 51 pp., 1984.

*FHWA-

AK-RD-85-02 Mageau, D.W., and J.W. Rooney, Thermal Erosion of Cut Slopes in Ice Rich Soils, 94 pp., 1984.

AK-RD-85-03 Zarling, J.P., and W.A. Braley, Heat Loss Factors for Insulated Building Foundations, 67 pp., 1984.

AK-RD-85-04 Aspnes, J.D., R.P. Merritt, and B.W. Evans, Rural Alaska Electric Power Quality, 71 pp., 1984.

AK-RD-85-05 Zarling, J.P., W.A. Braley, J.S. Strandberg, and S.W. Bell, Thermal Properties of Metal Stud Walls, 41 pp., 1984.

FHWA-

AK-RD-85-06 Ashton, W.S., and R.F. Carlson, Determination of Duration, Seasonal and Regional Aspects of Stream Flow With Respect to Fish Passage Through Highway Culverts, 51 pp., 1984.

FHWA-

AK-RD-85-07 Esch, D.C., Asphalt Pavements Modified With Coarse Rubber Particles -- Design, Construction, and Ice Control Observations, 50 pp., 1984.

FHWA-
 AK-RD-85-08 Connor, B.G., Asphalt Surface Treatment and Sealing Parameters, 26 pp., 1984.

AK-RD-85-09 J.S. Strandberg Consulting Engineers Inc., and the Institute of Water Resources, University of Alaska Fairbanks, State of Alaska Public Building Inventory Analysis, 18 pp., 1984.

FHWA-
 AK-RD-85-10 Esch, D.C., Surface Modifications for Thawing of Permafrost, 16 pp., 1984.

FHWA
 AK-RD-85-11 Osterkamp, T.E., Temperature Measurements in Permafrost, 93 pp., 1984.

FHWA-
 AK-RD-85-12 Electromagnetic Induction Measurements in Permafrost Terrain for Deicing Ground Ice and Ice-Rich Soils,

FHWA-
 AK-RD-85-13 Connor, B.C., Remote Monitoring of Thaw Depth, 13 pp., 1984.

FHWA-
 AK-RD-85-14 Connor, B.C., Use of High Float Emulsion Asphalt in Alaska, 12 pp., 1985

FHWA-
 AK-RD-85-15 McHattie, R.L., Deflection Testing and Its Application to Pavement Rehabilitation in Alaska, 102 pp., 1985.

FHWA-
 AK-RD-85-16 Reckard, M.K., White Paint for Highway Thaw Settlement Control, Interim Report, 34 pp., 1985.

- AK-RD-85-17 Jensen, G.A., Acceptability Testing of Radioluminescent Lights for VFR-Night Air Taxi Operations, 65 pp., 1984.
- AK-RD-85-18 Miller, P., and L. Hegdal, Proposal for Radioluminescent Runway Lights in Central, Alaska, 1985, 15 pp., 1985.
- AK-RD-85-19 Braley, W.A., A Personal Computer Solution to the Modified Berggren Equation, 16 pp., 1984.
- AK-RD-85-20 Seifert, R., Passive Solar Alaskan School, Final Report, 41 pp., 1984.
- AK-RD-85-21 Seifert, R., and B. Mueller, An Analytical Study of Passive Solar Energy and Mass Storage, Observations from a Test Building in Fairbanks, Alaska, 55 pp., 1983.
- AK-RD-85-22 Seifert, R., An Analytical Study of Low Mass Walls, Shutters, and Thermal Properties, Supplement to Passive Solar Alaskan School, 28 pp., 1983.
- AK-RD-85-23 Strandberg, J., and Bell, Two Rivers School Daylighting Tests, 41 pp., 1984.
- AK-RD-85-24 Data Report for a Hydraulic Evaluation of Fish Passage Through Roadway Drainage Structures in Alaska,
- AK-RD-85-25 Reckard, M.K., Hot Sand for Improved Traction on Icy Roads: Estimations of Costs and Benefits, 7 pp., 1985.
- AK-RD-85-26 DOT&PF Research Section, Research Procedures Manual,
- AK-RD-85-27 Venkatesh and S. Kutterer, Corrosion of Steel in Calcium-Magnesium-Acetate (CMA) Deicer.

- AK-RD-85-28 Vita, C.L., J.W. Rooney, C.H. Riddle and L.J. Acomb, Dalton Highway: Characterization of Foundation Soils, 81 pp., 1984.
- AK-RD-85-29 Davies, John N., A Refraction Profile from Hatcher Pass to Seward, South Central Alaska, 20 pp., 1985.
- FHWA-
AK-RD-85-30 Miles, Mark, and Robert Carlson, Design Considerations for River Training Structures and Tanana River Case Study.
- AK-RD-85-31 Moses, T.L., and H. Livingston, Product Evaluation for Armorflex and Armorform Erosion Control Systems, 1985.
- AK-RD-85-32 Field and Laboratory Study of the Use of Geotextiles to Bridge Thermokarsts.
- AK-RD-85-33 DOT&PF Research Section, Summary of Research - FY85,

ALASKA DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES
RESEARCH SECTION

RESEARCH NOTES

FY85

SAND CONFINEMENT GRIDS

July 1984, Volume 4, Number 1, Billy Connor

SNOW CONTROL STRUCTURES

August 1984, Volume 4, Number 2, David Esch

THERMAL CRACKING OF ASPHALT PAVEMENT

September 1984, Volume 4, Number 3, Robert L. McHattie

HIGHWAY PAVEMENT CONDITION INVENTORY IN ALASKA

October 1984, Volume 4, Number 4, Al Brawner

RUMBLE STRIPS

November 1984, Volume 4, Number 5, John F. Rezek

PERFORMANCE OF BURIED INSULATION LAYERS

December 1984, Volume 4, Number 6, David Esch

WHITE PAINT FOR HIGHWAY THAW SETTLEMENT CONTROL

January 1985, Volume 4, Number 7, Matthew K. Reckard

RADIOLUMINESCENT TAXIWAY LIGHTS

February 1985, Volume 4, Number 8, Lorena A. Hegdal

RURAL POWER QUALITY AND STATE FACILITIES

March 1985, Volume 4, Number 9, Leroy E. Leonard

ROOF ICING

April 1985, Volume 4, Number 10, Stephen Kailing

PILE FROST HEAVE FORCES

May 1985, Volume 4, Number 11, David C. Esch

MODIFIED BERG EQUATION

June 1985, Volume 4, Number 12, Billy Connor

SECTION 8
ACKNOWLEDGEMENTS

During the past year the Research Program has received assistance and cooperation from many individuals within the Department, from state and federal agencies, and from companies in private industry. These contributions to the objectives of the Department are appreciated. The activities of the Research Sections are guided by the Research Advisory Boards composed of the following members:

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